DOCUMENT RESUME

ED 054 317 VT 010 848

AUTHOR	Mayo, Clyde C.
TITLE	Three Studies of Job Inventory Procedures: Selecting Duty Categories, Interviewing, and Sampling.
INSTITUTION	Lifson, Wilson, Ferguson, and Winick, Inc., Dallas, Tex.
SPONS AGENCY	Air Force Personnel Research Div., Lackland AFB, Tex.
REPORT NO	AFHRL-TR-69-32
PUB DATE	Nov 69
NOTE	16p.
EDRS PRICE	EDRS Price MF-$0.65 HC-$3.29
DESCRIPTORS	*Armed Forces, Bibliographies, *Interviews, *Job Analysis, *Sampling, Tables (Data)
IDENTIFIERS	Technical Advisers, *United States Air Force

ABSTRACT

Three United States Air Force job inventory procedures were studied in depth, categorizing task statements by duties, interviewing technical advisers for job information, and detecting bias in survey samples. Variations in the usual grouping of supervisory tasks were found to be occasionally necessary. Depending upon the career ladder surveyed, nonsupervisory tasks are best organized by work section, function, or equipment format. Criteria are suggested for determining the point at which interviews become more productive than publication research. Interviewing is more effective when advisers are chosen according to experience, rank, kind of organization to which assigned, and job type. An analysis of trends in 10 survey samples showed few unexplainable underrepresentations. (Author)

99

AIR FORCE HUMAN RESOURCES LABORATORY

ED054317

AFHRL-TR-69-32

THREE STUDIES OF JOB INVENTORY PROCEDURES: SELECTING DUTY CATEGORIES, INTERVIEWING, AND SAMPLING

By

Clyde C. Mayo

Lifson, Wilson, Ferguson, and Winick, Inc.

PERSONNEL RESEARCH DIVISION
Lackland Air Force Base, Texas

November 1969

This document has been approved for public release and sale; its distribution is unlimited.

VT010848

AIR FORCE SYSTEMS COMMAND

BROOKS AIR FORCE BASE, TEXAS

NOTICE

When US Government drawings, specifications, or other data are used for any purpose other than a definitely related Government procurement operation, the Government thereby incurs no responsibility nor any obligation whatsoever, and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise, as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Composition: Hope De La Cruz
Mary L. Alvarado

ED054317

AFHRL-TR-69-32

November 1969

THREE STUDIES OF JOB INVENTORY PROCEDURES: SELECTING DUTY CATEGORIES, INTERVIEWING, AND SAMPLING

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

By

Clyde C. Mayo

Lifson, Wilson, Ferguson, and Winick, Inc.

This document has been approved for public release and sale;
its distribution is unlimited.

PERSONNEL RESEARCH DIVISION
AIR FORCE HUMAN RESOURCES LABORATORY
AIR FORCE SYSTEMS COMMAND
Lackland Air Force Base, Texas

ED024211

FOREWORD

This report, prepared by Lifson, Wilson, Ferguson, and Winick, Inc. under Contract F41609-68-C-0016, is one of three published as a product of this contract. The other reports in the series are AFHRL-TR-69-27, *Construction and Administration of Ten Air Force Job Inventories,* and AFHRL-TR-69-35, *A Method for Determining Job Types for Low Aptitude Airmen.* Clyde C. Mayo was the Project Director. Dr. Joseph E. Morsh monitored the contract for the Personnel Research Division. Printed materials used in the study were reproduced by Personnel Research Division, Air Force Human Resources Laboratory.

This study was performed under Project 7734, Development of Methods for Describing, Evaluating, and Structuring Air Force Occupations; Task 773401, Development of Methods for Collecting, Analyzing, and Reporting Information Describing Air Force Specialties.

ABSTRACT

Three United States Air Force job inventory procedures were studied in depth: categorizing task statements by duties, interviewing technical advisers for job information, and detecting bias in survey samples. Variations in the usual grouping of supervisory tasks were found to be occasionally necessary. Depending upon the career ladder surveyed, non-supervisory tasks are best organized by work section, by function, or by equipment format. Criteria are suggested for determining the point at which interviews become more productive than publications research. Interviewing is more effective when advisers are chosen according to experience, rank, kind of organization to which assigned, and job type. An analysis of trends in ten survey samples showed few unexplainable underrepresentations.

SUMMARY

layo, C.C. *Three studies of job inventory procedures: selecting duty categories, interviewing, and sampling.* AFHRL-TR-69-32. Lackland AFB, Tex.: Personnel Research Division, Air Force Human Resources Laboratory, November 1969.

roblem

In the research program in occupational structures in the Air Force, effort is continually directed oward improvement of procedures and development of new methodological approaches to job analysis.)uring the construction and administration of experimental inventories for several Air Force career ladders, number of observations were made and experiences were gained which seemed to have practical value and eneral applicability as guidelines for development and administration of job survey instruments.

ıpproach

Three aspects of job survey methodology were examined. Alternative variations in categorization of asks were evaluated; principles were enunciated for timing interviews in relation to publications review, nd some guidelines were established for selection and appraisal of interviewees; and, finally, a statistical ıethod for measuring sample bias was applied to demonstrate the representativeness of the survey samples. n the sections on categorizing tasks and interviewing, examples from the experimental inventories were sed to illustrate applications of the principles. In the section on sample bias, data on the composition of he survey samples were presented and evaluated to indicate the degree to which the samples were epresentive of the career ladder populations.

ıesults and Conclusions

A number of conclusions may be drawn from study of the three aspects of job inventory construction nd administration.

1. *Duty Categories.* Variations in the usual four-duty format fo upervisory tasks are occasionally ıecessary. Three rather stable organizations for non-supervisory tasks are the work section, function, and quipment formats. In the work section format, tasks are arranged in groups parallel to the work sections of rganizational charts. Tasks are grouped under typical functions charged to a career ladder in the function ormat. Tasks are arranged under equipment categories in the equipment format.

2. *Interviewing.* The value of interviews to derive job information can be enhanced by consideration f several factors. First, the point at which interviewing becomes more productive than publications esearch should be recognized. Second, interviewing is more productive when advisers are chosen on the asis of experience, present job type, rank, and size and type of installation of assignment. A variety of timuli, including questioning the form or content of task statements, can be used to elicit recall. A naximum of time can be spent with better interviewees and a minimum with poorer ones. Individual nterviews can be more effectively used during the early phases; group interviews are valuable later.

3. *Sampling.* Perfect correspondenc between sample and population strata is not necessary because ample sizes are typically quite large. Analyses of trends of over- and underrepresentation of various sample haracteristics can be used to ensure that survey samples are representative, however. An analysis of trends ı ten inventory samples showed few unexplainable underrepresentations.

This summary was prepared by J.E. Morsh, Occupational Research Branch, Personnel Research)ivision, Air Force Human Resources Laboratory.

TABLE OF CONTENTS

		Page
I.	Introduction	1
II.	Categorizing Tasks by Duties	1
	Supervisory Duties	1
	Non-supervisory Duties	1
III.	Interviewing Technical Advisers for Job Information	2
	Construction and Review of Job Inventories	2
	Initiation of Interviews	3
	Selection of Interviewees	3
	Substance of the Interview	4
	Types of Interviewees	5
	Types of Interviews	5
IV.	Job Inventory Sample Bias	6
	Results	7
	Discussion	9
V.	Summary and Conclusions	9
	References	9

TABLE

Table		Page
1	Representativeness of Survey Samples for Rank, Command, and Months of Active Federal Military Service	8

THREE STUDIES OF JOB INVENTORY PROCEDURES: SELECTING DUTY CATEGORIES, INTERVIEWING, AND SAMPLING

I. INTRODUCTION

The research program in occupational structures in the Air Force incorporates a comprehensive method of job analysis with data processing by electronic computer. The method is concise in that its stages are well defined; it is broad in that it is susceptible to continuing study and improvement. Basically, it consists of compiling lists of tasks from source materials, interviewing technical advisers for modification of the lists, mailing the resulting preliminary job inventory to advisers in the field for further modifications, compiling the final version, selecting a sample for administration, administering the final version to incumbents, and recording and analyzing the results (Morsh & Archer, 1967).

The studies presented were directed toward improvement in job analysis procedures. From observations and experience gained during the construction and administration of experimental job inventories, three aspects of job survey methodology were examined. Alternative variations in categorization of tasks were evaluated; principles were enunciated for timing interviews in relation to publications review, and some guidelines were established for selection and appraisal of interviewees; and finally, a statistical method for measuring sample bias was shown to be feasible. In the sections on categorizing tasks and interviewing, examples from the experimental inventories are used to illustrate applications of the principles. In the section on sample bias, data on the composition of the survey samples are presented to demonstrate the degree to which samples are representative of career ladder populations.

II. CATEGORIZING TASKS BY DUTIES

The task statements in a job inventory are arranged in some logical fashion to facilitate administration. When the subject perceives the logic of the arrangement of task statements, he is able to concentrate attention on those duties which best describe his job. A duty, which may include any number of tasks, is considered to be a large portion of the work performed by an individual (Morsh, Madden, & Christal, 1961). The particular arrangement of task statements by duty categories is individually selected for each job inventory. The broad headings in job training standards and organizational charts depicting work section subdivisions can be used as guidelines for defining duty categories.

Supervisory Duties

Usually, supervisory tasks are placed under one of four duty categories: (*a*) Planning and Organizing, (*b*) Directing and Implementing, (*c*) Evaluating, and (*d*) Training. The Planning and Organizing duty covers tasks related to personnel, supply, equipment, budget, and workload control. This duty is designed to assess the kinds of administrative tasks performed by senior noncommissioned officers (NCOs). The Directing and Implementing duty assesses the role of the senior NCO in direct supervision. Such task statements as "Supervise the stock records section" and "Supervise the maintenance of diesel engines" are included. The Evaluating duty covers those supervisory tasks which involve evaluating reports, suggestions, facilities, and the work of subordinates. The Training duty assesses the supervisory tasks involved in conducting on-the-job and formal training.

There are important variations from the normal format for supervisory tasks. For example, if several career ladders are being surveyed with a single inventory, all supervisory tasks for each career ladder might best be listed within a single duty. In the Data Systems Job Inventory (AFSC 68XXX), which surveyed five career ladders, there were five supervisory duties, each covering one career ladder. Occasionally a career ladder is encountered in which there are few supervisory tasks. For example, in the Weather Career Ladder (AFSC 253X0), personnel at the apprentice, technician, and superintendent levels perform overlapping functions. The apprentice is basically a weather forecaster, as are the technician and superintendent. In the Weather Job Inventory, therefore, a single supervisory duty, "Supervising Weather Operations," was constructed which listed all supervisory tasks.

Non-supervisory Duties

There are three basic formats for arranging non-supervisory tasks. These are the work section, the function, and the equipment formats. Combinations of the three can be effectively utilized; occasionally, a pure format can be used. When arranging the duty format, the inventory constructor

decides whether function, section, or equipment constellations are prominent in the career ladders under analysis. He should remain flexible, however, and be able to intermingle several approaches in one inventory if necessary. Brief descriptions of the three inventory formats follow.

1. *Work Section Format.* Incumbents in some career ladders serve functions in which workloads are defined by organizational chart. The job inventory format for these career ladders can incorporate duty headings which are equivalent to the work sections of the organizational chart. For example, Base Accounting and Finance Offices are typically divided into sections for Travel, Civilian Pay, Military Pay, Accounts Control, Commercial Services and Material, Paying and Collecting, Stock Funds, and Non-appropriated Funds. For the most part, job types are parallel to these work sections. In the Accounting and Finance Job Inventory, the duty titles included "Processing Military Pay," "Maintaining Accounts Control," and "Paying and Collecting." In completing the inventory, an incumbent who worked in the Military Pay section probably spent a maximum amount of time on the duty "Processing Military Pay" and a minimum on the other duties.

The work section format usually includes a general duty listing tasks which are the same no matter where they are performed. The purpose of the general duty is to eliminate the duplication of task statements between duties. For example, in the Jet Engine Mechanic Career Ladder, the task "Cover engine openings" is performed both at the flight line and in the engine repair shop. Therefore, the task was listed in the job inventory under the general duty "Maintaining Jet Engines," rather than under flight line or repair shop duties.

2. *Function Format.* The function format may be used in two ways. First, it may be used in a job inventory for a career ladder which has the responsibility of maintaining one large class of equipment. The duty headings in this case begin with typical maintenance verbs or functions. For example, the Helicopter Mechanic (AFSC 431X0) is responsible for the entire aircraft. He inspects, troubleshoots, adjusts, repairs, and performs preventive maintenance on helicopter components and systems. Therefore, in the job inventory for this career ladder, duty titles such as "Inspecting Helicopter Components," "Servicing Helicopters," and "Removing and Replacing Helicopter Components" were used.

The second way in which a function format may be used is much more general. It may be applied to career ladders in which the work consists of performing diverse functions on differing classes of equipment, personnel, or other subject matter. In these cases, the inventory constructor must search for ways to divide the work into broad functions in which the tasks are cohesive because of some common denominator. In such career ladders as Preventive Medicine (AFSC 907X0), Dental Laboratory Specialist (AFSC 982X0), or Weather (AFSC 253X0), the work is not defined by organizational chart, does not involve a single class of equipment, and cannot be described with a limited number of typical verbs such as "troubleshoot" or "inspect." The Preventive Medicine Specialist, for example, performs military public health functions, epidemiological functions, and bio-environmental engineering functions. Each of these activities or functions is relatively independent, since there is little transfer of training from one function to another. Once these functions were isolated during inventory construction, duty headings such as "Performing Bio-environmental Engineering" or "Performing Military Public Health Functions" were developed.

3. *Equipment Format.* In career ladders in which members are responsible for the maintenance of different types of equipment, an equipment-oriented format is useful. For example, Electrical Power Production Specialists (AFSC 543X0) maintain air compressors, centrifuges, cooling systems, diesel engines, exciters, gasoline engines, generators, intake and exhaust systems, and switchgear. The best single format for the job inventory in this instance is one in which the duty titles are associated with each equipment group. In the inventory, therefore, typical duty titles were "Maintaining Diesel Engine," "Maintaining Generators," and "Maintaining Intake and Exhaust Systems."

III. INTERVIEWING TECHNICAL ADVISERS FOR JOB INFORMATION

Construction and Review of Job Inventories

The construction of a job inventory involves three phases. First, the inventory constructor consults training and technical publications which describe the work content of the career ladder under analysis. From these publications he abstracts task statements and arranges them under duty headings. Next, in interviews with technical advisers (i.e., members working in the career ladder), the inventory constructor solicits recommendations for additions, changes, or deletions to the list. Finally, a preliminary version of the inventory is printed and mailed to technical advisers in the field who are asked to add written comments.

Initiation of Interviews

In general, interviewing begins when the constructor's reading of publications about work content has reached a point of diminishing returns. Although criteria for the decision to begin interviewing are subjective, there may be several indications to the constructor that interviewing would be more productive than further reading.

1. In the normal situation, the constructor will need elaboration of detail from interviewees after he has developed a preliminary inventory consisting of 150 to 200 tasks.

2. Occasionally, the constructor may continue reading publications to uncover additional tasks. If he finds that there are fewer and fewer task statements per page, however, it is possible that the source materials are too specific. In this case, the constructor's time is best spent in interviewing.

3. In some career ladders, the subject matter may be so complex that it is incomprehensible to the constructor. In such cases, discussion with technical advisers is probably more fruitful for the constructor than his independent reading. For example, in reading Career Development Course volumes for the Electronic Computer Repairman Career Ladder (AFSC 305X3), the inventory constructor encountered a chapter on Boolean Algebra. The time of the constructor was best spent in asking technical advisers what tasks involved the use of Boolean Algebra, rather than in learning Boolean Algebra and deducing its use.

4. An inventory constructor might wish to see the work being performed so that he can better understand the publications he has read. If the constructor is able to arrange tours of work activities, he will usually heighten his interest in and understanding of the career ladder.

Selection of Interviewees

Since the final version of the job inventory is used to survey work performed in various commands, including work performed at overseas and continental United States duty sites, the best possible interviewee is a senior NCO who has served in all commands both stateside and overseas. Since such a person is a rarity, the usual strategy is to select several senior NCOs, each of whom has had experience in several work situations. The most important selection factor is the particular work experience. In maintenance career ladders, for example, incumbents tend to specialize on certain kinds of equipment. There are Electronic Computer Repairmen who have never worked on display equipment, even though display equipment is in the job training standard for that career ladder. There are Aircraft Inertial and Radar Navigation Systems Repairmen who have never worked on forward-looking or side-looking radar, even though these equipments are in the job training standard for that career ladder. The first rule, then, is to make sure that as many different kinds of work experience as necessary are being tapped.

Apprentice level airmen are sometimes better able to provide useful information about specific jobs than are supervising personnel who are not engaged in the activities at the working level. In such cases, the constructor probably will be referred to the lower level airman. For example, when interviewing in the Accounting and Finance Career Ladder (AFSC 67XXX), the constructor was referred to an apprentice level airman who worked in the Military Pay Computer Unit. The tasks there were familiar to the apprentice since he performed them on a daily basis.

It is helpful to interview officers or civilians at appropriate levels when knowledge of administrative matters is required. For example, officers who worked in Base Accounting and Finance Offices were helpful because of their overall knowledge of document flow from one section to another. Although a senior NCO was in charge of the Travel Section, one of the officers was in a position to observe the interrelation of the Travel and other Accounting and Finance sections. In general, officers can be helpful in setting up appointments with enlisted men, since the officers are in a position to know the background and current responsibilities of the men.

Instructors at technical schools are generally regarded as the best single group of advisers. As a rule, these advisers are technically competent, are capable of communicating with others about the work, and are knowledgeable of both usual and unusual work situations in their career ladders. Further, interviews conducted at technical schools tend to be especially productive since individuals with different backgrounds are often congregated there.

The scope of the technical adviser's job frequently depends upon the size of his organization or installation. For example, if he is with a large organization, it is possible that his job is more specialized than it would be at a small organization. If technical advice is solicited from members of a large organization, it is important to obtain several interviews to ensure a complete picture of the tasks in the career ladder. In contrast, if the

organization is small and is serving a small installation, but has the same function as a large organization at a large base, the interviewing requirements are different. Incumbents at the small organization are likely to be familiar with the entire function of the organization; therefore, fewer interviews are needed.

Not only does the function of the organization differ at small and large installations, but the method of performing the function may also be different. Further, a particular function may be assigned to a career ladder even though it is only performed at one or two bases. An example of one of these variations is the Medical Materiel Specialist serving a small 10-bed dispensary who uses manual item-accounting procedures, contrasted with the Specialist serving a 500-bed hospital who uses mechanized item-accounting procedures—a completely different system. As another example of duty variation within a career ladder, there are only a few individuals in the Preventive Medicine Career Ladder who monitor the handling of dangerous missile fuel mixtures. The inventory, of course, must account for the tasks performed by the few as well as those performed by the many.

Substance of the Interview

The job survey interview is a fact-finding device, similar in many aspects to the market research interview. Since the interview is not perceived in the light of a personnel evaluation or a typical supervisor-subordinate relationship, there is little likelihood that it will be threatening to the interviewee. Rapport is important, of course, but the primary objective of the interviewer is to stimulate the memory of the interviewee. The interviewer must make sure that the adviser does not perceive the interview as an investigative or evaluative one; he must inform the interviewee that he is interested in job information only. Most advisers are eager to participate in the interview. They are told that they are contributing to an Air Force survey of their career ladders and that letters of appreciation for their contributions will be sent to their commanding officers.

In the interview, each adviser is presented with a list of tasks arranged under duty headings for his career ladder. He is asked to reword, delete, or make additions to the tasks. The chief advantage of this checklist method is that it stimulates recall. In the preliminary task list, the omission of a whole duty or work area probably is more detrimental to the inventory than the omission of some tasks under a duty for which other tasks have already been listed. In cases in which significant tasks are omitted from a defined duty, the tasks can be quickly added by the advisers. On the other hand, advisers are less likely to recall a major duty or work area which has been omitted, since there is no memory stimulus for it. Therefore, the discovery and documentation of broad work areas is initially more important than the elaboration of individual tasks within a broad work area. For example, a Preventive Medicine Specialist was shown a list of organisms which members of his career ladder must be able to collect and identify. Because of the frame of reference provided in the duty category "Collecting and Identifying Organisms," he was quickly able to recall two organisms which had been omitted from the list.

It has been shown that an interviewer can also promote the adviser's recall by a particular questioning technique (Morsh & Archer, 1967). For example, the interviewer might ask any one of several probing questions:

> Is this the only way the task can be performed? Is there another way?
>
> What is the difference between this task and task E-12 on the previous page?
>
> Will this task as stated also cover the same function as performed at command level?
>
> Is it better for these tasks to refer to components in general, or should they refer to components of specific equipment?
>
> Is this task at the same level of specificity as the other tasks? Should it be broken down into smaller tasks?

Such questions are not leading; they do not obscure information or interject interviewer bias. They merely ask the adviser to expand on what he has already told the interviewer. Their chief purpose is memory stimulation. An adviser can often bring up new associations and offer new information or new ways of organizing the material through such stimulation.

It is important that semantic problems be clarified during interviews. The interviewer must look for indications that a particular task statement may have different meanings for different incumbents. He must be alert to task statements which are worded ambiguously. For example, the statement "Monitor workloads of shop personnel" may be interpreted to mean "Make work assignments," "Prepare manning documents," or "Edit time cards of shop personnel." The method by which a task is performed is a crucial variable, particularly in cases where the incumbent is not

likely to be acquainted with all methods of performing a given task. For example, a lineman on a telephone cable installation crew pointed out in interview that the task "Dig cable trenches" could be accomplished either with hand tools or with trenching machinery. Since all incumbents would not have access to trenching machinery, it was necessary to make this distinction in the task statement. In contrast, the methods of performing some tasks are so variable that a general format is more appropriate. For example, the statement "Coordinate with supply activity to solve supply problems" is a more economical construction than a series of statements depicting each type of problem and each method used to solve the problem.

Types of Interviewees

Since some technical advisers are better interviewees than others, the constructor learns to spend a minimum of time with noncommunicative advisers and a maximum with more helpful advisers. For practical purposes, technical advisers can be described on the basis of their interview behavior as good, average, and poor interviewees.

1. *Good Interviewees.* The most important characteristic of a good interviewee is that he is concerned with personnel and management problems in his career ladder. He is aware that the inventory is an instrument designed to analyze the task structure of his Air Force occupation. He is highly motivated and feels a sense of personal involvement in the study. Although he gives information about his present assignment, his thinking encompasses Air Force-wide situations. If either the content of the task statements or the duty structure of the inventory is amiss, he is capable of mentally reorganizing the inventory format. Good interviewees tend to be characterized by one of two behavior patterns. The first type of individual tends to be rather mature, solid, and authoritative, identifying strongly with his career ladder. He may even have a kind of paternalistic attitude about his career ladder, feeling that he is in a position to guide and develop younger members. He is capable of being critical without being destructive. The second type of individual tends to be meticulously attentive to detail, attempting to show or tell the interviewer everything that he knows about this career ladder. He is quite talkative and produces an abundance of job information. Both types of interviewees are willing to spend as much time as necessary with the interviewer to ensure that the subject is completely covered.

2. *Average Interviewees.* An average interviewee is capable of reviewing and adding to the inventory, but his coverage does not tend to be exhaustive. Perhaps because of a lack of experience or a lack of curiosity, his Air Force orientation is somewhat circumscribed. His tends to regard the inventory as just one more set of paperwork to be reviewed. He may be a clockwatcher, willing apparently to give only a limited amount of time to the interview. He needs to be questioned often to stimulate his memory.

3. *Poor Interviewees.* Poor interviewees tend to be characterized by one of several kinds of behavior. The first pattern suggests an individual who is essentially unmotivated to participate in the study; possibly he is doing so only because ordered to by a supervisor. The second pattern suggests an individual who is somewhat antagonistic to the interviewer; he conveys the impression that the interview is a waste of time and that he would like to terminate it as soon as possible. The third pattern suggests a person who accepts the form and content of the inventory rather passively without adding significant contributions. Finally, there is an individual who seems to be extremely critical of the entire project. He usually maintains that his work is too complex to describe and generally disregards the value of any job inventory or the validity of any job description derived from an inventory.

The words "good," "average," and "poor" as used are intended to describe types of interview behaviors only and have no reference to the general adequacy of incumbents on the job. The interviewer can usually perceive early in the session whether the interviewee is good, average, or poor. It is sometimes difficult, however, to discriminate the authoritative "good" interviewee from the hypercritical "poor" interviewee, especially if the career ladder being surveyed requires a technical knowledge foreign to the constructor's own experience. In such cases it may be difficult for the interviewer to discern whether criticisms offered are the constructive ones of an authoritative "good" interviewee or the noncommunicative ones of a hypercritical "poor" interviewee.

Types of Interview

Studies have shown that individual interviews are most effective during early stages; group interviews are valuable near the end of the interviewing

process (Archer & Fruchter, 1963). In an individual interview, the interviewee seems to be under no group pressure to conform, and he tends to produce information without fear of contradiction. Also, he receives all of the interviewer's attention. On the other hand, group interviews are most helpful after the basic inventory has been constructed and some agreement on semantics is needed.

IV. JOB INVENTORY SAMPLE BIAS

The sample of airmen surveyed in a job inventory administration is usually quite large. A sample rarely includes less than 20 percent of the population of a given career ladder. A more usual figure is 40 to 50 percent; for many career ladders, 100 percent sampling is attempted. Samples in recent studies have averaged from 1,150 to 1,250 subjects (Mayo, 1968). Since the use of large samples ensures adequate coverage of work performed in any career ladder, why, then, should samples be studied for possible bias? The answer is that there are factors affecting sample composition which are beyond the control of inventory sample designers.

First of all, incumbents may be difficult to trace because of reassignment actions or temporary duty assignments. Secondly, there is the possibility of discrepancy between manning documents in the office which originates job inventories and those in the field. The status of Air Force manpower is constantly changing and cannot be expected to remain stable for research purposes. Also, inventories are administered only to those incumbents who have remained on the same duty assignment for at least six weeks. The number with at least six weeks' residency in the same assignment may fluctuate from month to month.

Since large samples are typically the case, however, none of the foregoing variables should significantly bias a given survey. Conversely, information regarding trends in under- or overrepresentation of given strata in several samples should be valuable to sample designers. For example, if a trend analysis revealed that airmen with overseas assignments were consistently underrepresented, efforts could be made to increase their representation. Results showing such a trend would at the very least justify a study designed to discover the cause of such underrepresentation.

In the present study, trends of under- and overrepresentation for selected variables were analyzed across ten job inventory samples. The following variables were studied:

Variables

Rank
1 Airman Basic
2 Airman
3 Airman First Class
4 Sergeant
5 Staff Sergeant
6 Technical Sergeant
7 Master Sergeant
8 Senior Master Sergeant
9 Chief Master Sergeant

Location
1 Continental United States
2 Overseas (Including Alaska and Hawaii)

Sex
1 Female
2 Male

Major Command
1 Alaskan Air Command
2 Air Defense Command
3 Air Force Accounting and Finance Center
4 Air Force Communications Service
5 Air Force Logistics Command
6 Air Force Systems Command
7 Air Training Command
8 Air University
9 Continental Air Command
10 Headquarters Command
11 Headquarters, United States Air Force
12 Military Airlift Command
13 Pacific Air Force
14 Strategic Air Command
15 Tactical Air Command
16 United States Air Force Academy
17 United States Air Forces in Europe
18 United States Air Forces Southern Command

Months of Active Federal Military Service
1 1 to 12 months
2 13 to 24 months
3 25 to 48 months
4 49 to 96 months
5 97 to 144 months
6 More than 144 months

Enlistment
1 First
2 Other than first

The chi-square one-sample test for goodness-of-fit was used to test for sample bias. If the observed frequency of a variable was significantly different from the expected frequency at the .01 prob-

ability level, that variable was declared misrepresentative. Three types of fit were documented: representative, underrepresentative, and overrepresentative. In this discussion, misrepresentations of variables are considered to be biased. The term "biased" is used in a statistical sense only, however; the samples were much too large to be meaningfully biased. For example, if the observed frequency for a variable was 250 and the expected frequency was 300, the chi-square test would be significant at the .01 level. However, 250 subjects would be entirely adequate for any variable in question. Again, the purpose of the study was to discern whether trends of misrepresentation existed for any of the variables selected.

Students at various Air Force technical training centers were considered as population members in all career ladders surveyed; however, students were not typically included in samples. Therefore, misrepresentations were expected for those variables which would be affected by the lack of students in the samples. More specifically, biases of underrepresentation were expected for airmen in the ranks of Airman and Airman First Class, for members with 1 to 12 of months active federal military service, and for members assigned to Air Training Command. Job inventory samples for the following career ladders were studied:

AFSC	Title	Sample Size
20XX0	Intelligence Operations; Photo Interpreter	1,590
301X4	Aircraft Inertial and Radar Navigation Systems Repair	1,209
305X3	Electronic Computer Repair	1,082
322X1	Weapon Control System Mechanic	1,316
46XX0	Munitions; Weapons Mechanic	2,630
543X0	Electrical Power Production	1,439
67XXX	Accounting and Finance	1,530
68XXX	Data Systems	4,732
903X0	Radiology	568
906X0	Medical Administrative	1,355

Results

The results of the analyses for the variables Rank, Command, and Months of Active Federal Military Service are shown in Table 1. In the table, an "r" (r = representative) signifies that the chi-square test for the variable was not significant; an "o" (o = overrepresentative) means that the test was significant at the .01 level, with an observed value larger than the expected value; and a "u" (u = underrepresentative) signifies that the test was significant at the .01 level, with an expected value larger than the observed value. Results for each of the variable categories are discussed separately in the following paragraphs.

1. *Sex.* The 20XX0, 67XXX, 68XX0, 903X0, and 906X0 career ladders were the only ones in the study composed of members of both sexes. Results showed that each of the five samples was representative of the population with respect to the variable Sex.

2. *Rank.* The results for the variable Rank are included in Table 1. It is apparent that a large majority of the levels of rank were representative. However, the rank Airman was underrepresented in each sample except for 906X0. The rank Airman First Class was underrepresented in the 301X4, 46XX0, and 906X0 samples and overrepresented in the 67XXX sample. The rank Sergeant was overrepresented in all samples except for 906X0 and 67XXX; the latter rank was representative for 906X0 and underrepresentative for 67XXX. All other levels of rank were representative for all ten career areas.

3. *Location.* All samples were representative for the variable Location except for 543X0 and 903X0, in which airmen stationed in the continental United States were overrepresented.

4. *Command.* Results for the variable Command are included in Table 1. The commands AFAFC, AFCS, AFLC, CONAC, HQ COMD, HQ USAF, MAC, and USAFA were misrepresented in no more than 20 percent of the sample. AU and SAC were overrepresented in 20 percent of the samples and underrepresented in 10 percent. AAC, ADC, AFSC, TAC, and USAFSO were overrepresented in from 30 to 60 percent of the samples and minimally underrepresented. USAFE was underrepresented in 20 percent and overrepresented in 20 percent. ATC was underrepresented in 70 percent and PACAF in 40 percent.

5. *Months of Active Federal Military Service.* Results for the variable Months of Active Federal Military Service are also included in Table 1. Airmen with 1 to 12 months of service were underrepresented in all samples except for 903X0 and 906X0, in which they were representative. Airmen with 13 to 24 months of service were overrepresented in all samples except for 20XX0, 46XX0, and 906X0, in which they were underrepresented, and 903X0, in which they were representative. Airmen with 25 to 48 months service were overrepresented in all samples except for 543X0, 67XXX, 903X0, and 906X0, in which they were

representative. Airmen with 49 to 96 months service were overrepresented in the 543X0 sample; airmen with 144 or more months service were underrepresented in the 301X4 sample. All other variable levels were representative in each sample.

6. *Enlistment.* The results for the variable Enlistment showed that all samples were representative except for the 20XX0, 46XX0, 46XX0, and 543X0 samples, in which airmen serving on their first enlistment were underrepresented.

Table 1. **Representativeness of Survey Samples for Rank, Command, and Months of Active Federal Military Service**

(Representativeness: r = representative; u = underrepresentative; o = overrepresentative)

Variable	Representativeness of Variable for Career Ladder									
	20XX0	301X4	305X3	322X1	46XX0	543X0	67XXX	68XXX	903X0	906X0
Rank										
AB	r	r	r	r	r	r	r	r	r	r
Amn	u	u	u	u	u	u	u	u	u	r
A1C	r	u	r	r	u	r	o	r	r	u
Sgt	o	o	o	o	o	o	r	o	o	u
SSgt	r	r	r	r	r	r	r	r	r	r
TSgt	r	r	r	r	r	r	r	r	r	r
MSgt	r	r	r	r	r	r	r	r	r	r
SMSgt	r	r	r	r	r	r	r	r	r	r
CMSgt	r	r	r	r	r	r	r	r	r	r
Major Command										
AAC	r	r	o	o	o	o	o	o	r	r
ADC	r	o	o	o	r	o	r	u	r	r
AFAFC	r	r	r	r	r	r	o	r	r	r
AFCS	r	r	r	r	r	u	r	r	r	r
AFLC	r	r	r	r	o	r	r	u	r	r
AFSC	r	r	u	o	o	o	o	r	r	r
ATC	u	u	u	u	u	u	r	u	r	r
AU	r	r	r	r	r	r	o	o	r	u
CONAC	r	r	r	r	r	r	r	r	r	r
HQ COMD	u	r	r	r	r	r	r	u	r	r
HQ USAF	r	r	r	r	r	r	r	r	r	r
MAC	r	r	r	r	r	u	r	r	r	r
PACAF	r	r	u	r	u	r	u	r	r	u
SAC	o	r	o	r	r	r	r	r	r	u
TAC	o	o	r	r	o	o	r	o	r	r
USAFA	r	r	r	r	r	r	o	o	r	r
USAFE	r	r	r	u	o	u	r	r	r	o
USAFSO	r	r	r	r	o	o	o	r	r	r
Months of Active Federal Military Service										
1- 12	u	u	u	u	u	u	u	u	r	r
13- 24	u	o	o	o	u	o	o	o	r	u
25- 48	o	o	o	o	o	r	r	o	r	r
49- 96	r	r	r	r	r	o	r	r	r	r
97-144	r	r	r	r	r	r	r	r	r	r
144+	r	u	r	r	r	r	r	r	r	r

Discussion

Overrepresented variables are not as much of a problem as underrepresented ones since lack of representation means loss of potential data while overrepresentation signifies an abundance of data. With respect to the variables Location and Months of Active Federal Military Service, it was fortunate that the rank Sergeant and the months of service 13 to 24 months and 25 to 48 months were the variable levels overrepresented. Airmen from these variable levels usually are at the worker or journeyman skill level, which is the most important skill level to be studied in a job analysis.

The underrepresented variable levels were generally those which could be predicted from the knowledge that student members were not included in the samples, with the single exception of the relatively high number of underrepresentations for the command variable PACAF. Poor return from members of PACAF may be attributable to the increasing complexity of administrative actions (including testing) in the Pacific and Far East.

The samples were largely representative with respect to sex, location, and enlistment.

V. SUMMARY AND CONCLUSIONS

Three aspects of job inventory construction and administration were studied in depth.These were the categorizing of task statements by duties, the interviewing of technical advisers for job information, and the composition of inventory samples. The conclusions may be summarized as follows:

1. *Duty Categories.* Variations in the usual four-duty format for supervisory tasks are occasionally necessary. Three rather stable organizations for non-supervisory tasks are the work section, function, and equipment formats. In the work section format, tasks are arranged in groups parallel to the work sections of organizational charts. Tasks are grouped under typical functions charged to a career ladder in the function format. Tasks are arranged under equipment categories in the equipment format.

2. *Interviewing.* The value of interviews to derive job information can be enhanced by consideration of several factors. First, the point at which interviewing becomes more productive than publications research should be recognized. Second, interviewing is more productive when advisers are chosen on the basis of experience, present job type, rank, and size and type of installation of assignment. A variety of stimuli, including questioning the form or content of task statements, can be used to elicit recall. A maximum of time can be spent with better interviewees; a minimum with poorer ones. Individual interviews can be more effectively used during the early phases; group interviews are valuable later.

3. *Sampling.* Perfect correspondence between sample and population strata is not necessary because sample sizes are typically quite large. Analyses of trends of over- and underrepresentation of various sample characteristics can be used to ensure that survey samples are representative, however. An analysis of trends in ten inventory samples showed few unexplainable underrepresentations.

REFERENCES

Archer, W.B. & Fruchter, Dorothy A. *The construction, review, and administration of Air Force job inventories.* PRL-TDR-63-21, AD-426 755. Lackland AFB, Tex.: Personnel Research Laboratory, Aerospace Medical Division, August 1963.

Mayo, C.C. *Survey of twenty-eight Air Force career ladders with nineteen job inventories.* AFHRL-TR-68-109, AD-687 091. Lackland AFB, Tex.: Personnel Research Division, Air Force Human Resources Laboratory, July 1968.

Morsh, J.E. & Archer, W.B. *Procedural guide for conducting occupational surveys in the United States Air Force.* PRL-TR-67-11, AD-664 036. Lackland AFB, Tex.: Personnel Research Laboratory, Aerospace Medical Division, September 1967.

Morsh, J.E., Madden, J.M., & Christal, R.E. *Job analysis in the United States Air Force.* WADD-TR-61-113, AD-259 389. Lackland AFB, Tex.: Personnel Laboratory, Wright Air Development Division, February 1961.